NRC COMMENTS REGARDING
REMEDIAL ASSESSMENT WORK PLAN, DATED FEBRUARY 1991
FANSTEEL METALS, INC.
MUSKOGEE, OKLAHOMA

Page 3-14, Section 3.6:

Background sampling and measurements are to be characteristic of the area surrounding a site; 8 to 10 sampling locations are typically selected at distances of 1 to 10 km from the site in all compass directions.

Page 4-2, Section 4.1.1, Paragraph 3, Sentence 1:

"Three soil samples will be selected for analysis from each of the shallow borings." Subsurface evaluation of the site should be focused on known suspect areas and those identified from the screening effort. The decision to select 3 soil samples from core borings is unclear; the plan should discuss the rational for the selection of the 3 samples.

Page 4-12, Section 4.2.7.1:

See comments on Page 3-14, Section 3.6 above.

Page 4-18, Section 4.3, Paragraph 3:

A reference is made to action levels of gross alpha and gross beta in soil and sediments with units of pCi/l, these should be in units of pCi/g.

Pages A-6, A-10, A-11

References to Figure 3 apparently should be to Figure 12.

Page A-8, Section A.1.3.2.4., Paragraph 5, last sentence:

Provide additional information defining "An amount of nearby off-site data will also be accumulated for comparison purposes."

Enclosure 1

Page A-9 Section A.1.3.2.5., Paragraph 3: Gross alpha and beta anaylses can be used as a screening technique; however, for the purpose of comparing the site status to the NRC guidelines for cleanup of radionuclides specified in Federal Register Vol. 46, No. 205, October 23, 1981, Notices, p. 52061 (46 FR 52061), specific radionuclide analyses must be performed to quantify radionuclide concentrations in soil and other solid samples.

Page A-10, Section A.1.3.2.7.: What has been determined to be "appropriate detection instrumentation"? Provide type, manufacturer and model or define performance requirements relative to established guidelines. This section contains the first reference to "general site scanning." Provide additional details, e.g., instrumentation and procedures.

Page A-18, Section A.3.1.3.6., Paragraph 2: Does this discussion relate to total uranium and total thorium or to specific isotopes?

A statement is made that the detection limit for uranium in water, 1 ppb, is equal to 0.7 pCi/l, and the detection limit for uranium in soil, 1 ppb, is equal to 0.7 pCi/g. The conversion from ppb to pCi/l for water is correct, but the conversion from ppb to pCi/g for soil is incorrect. It should be 1 ppb in soil is equal to 7.0E-4 pCi/g.

Likewise, there is also a statement on page A-18 which says that the detection limit for thorium in water, 10 ppb, is equal to 2.2 pCi/l, and the detection limit for thorium in soil, 1 ppb, is equal to 0.2 pCi/g. The conversion from ppb to pCi/l for water is correct, but the conversion from ppb to pCi/g for soil is incorrect. It should be 1 ppb in soil is equal to 2.2E-4 pCi/g.

Page A-66, Sections A.6.1.8 and A.6.1.9, and Page A-69, Section A.6.2: The licensee is requested to commit to calibration by qualified parties as described in Section A.6.1.8.

Please also see enclosure 2 for separate comments on review of the conceptual Decommissioning Plan, dated February 1991, referred to by Fansteel Metals/Earth Sciences Consultants, Inc., to respond to the previous NRC comments on review of the Remedial Assessment Work Plan, dated June 1990.

NRC COMMENTS ON REVIEW OF THE DECOMMISSIONING
PLAN DATED FEBRUARY 1991 USED BY FANSTEEL METALS TO RESPOND TO
PREVIOUS NRC COMMENTS ON REVIEW OF REMEDIAL ASSESSMENT
WORK PLAN DATED JUNE 1990

General Comments:

Throughout this document there appears to be a lack of understanding of the measurements and analyses which are necessary in order to generate the appropriate data for comparison with the guidelines for release for unrestricted use. The intent, appears to be, to rely heavily on gross alpha and gross beta radiation measurements for all types of media. While this is adequate as a screening method, it cannot be used to demonstrate compliance with the guidelines. Further, if after Fansteel has removed source-material bearing sludges and wastes from the Muskogee site, the residual contamination is such that groundwater-drinking water pathway dose assessments are required to justify its remaining there, adequate data will be needed to support the dose assessments. In addition to the chemical and geohydrological parameters, the radionuclide identities and their quantities and distribution will be needed, for each radionuclide, for input to the assessment of potential doses through this pathway.

Based on previous experience, we recommend that the use of surface scans for soils, building and equipment surfaces be considered as a method for identifying areas requiring detailed assessments.

The appropriateness of performing surface radioactivity measurements (dpm/100 cm^2) only for alpha radioactivity should also be further evaluated. The nature of the activities conducted at these facilities, e.g., dust generating, use of corrosive liquids, etc., along with the decontamination procedures which abrade surfaces, may result in conditions which selectively attenuate alpha particles.

This could lead to an underestimation of the surface radionuclide contamination. In this situation, alpha measurements should be supplemented with measurements for the more penetrating beta radioactivity to assure a more accurate determination of radionuclide contamination on surfaces of your facilities.

There is no mention of procedures to be utilized to prevent cross contamination during the decommissioning process. Options which may be considered are the isolation of clean areas and intermittent monitoring of interface areas in conjunction with the use of appropriate control points.

Specific Comments:

1. Page 2-2, Paragraph 1: For soil, the fractional contributions of total uranium and total thorium must be evaluated to determine whether the guidelines for release for unrestricted use have been met.

   The write-up for groundwater implies that the three picocuries/liter of water discharge limit for radium-224 (from Th-232 from natural thorium) and radium-226 (from U-238 from natural uranium) and their daughter radionuclides is based on or derived from the "Old" 10 CFR 20.106 (revised as of January 1, 1991, 56 FR 23,360, May 21, 1991). The NRC staff have not been able to find this single three picocuries/liter limit for Ra-224 and Ra-226 and their daughters per se in Table II, Appendix B, Section 20.106 of the old 10 CFR Part 20. If this limit is derived by Fansteel and Earth Sciences Consultants, Inc., (ESC, Inc.,) from the 10 CFR Part 20 limits, please elaborate on the technical basis.

   It should be noted that the allowable concentrations of radionuclides in both the old and new 10 CFR Part 20 are really meant to be for liquid effluents to surface water in unrestricted areas from routine operations and not for groundwater protection at decommissioned sites.

This 3 pCi/l limit for ground water is a factor of about three to several orders of magnitude more restrictive than the NRC limits for each of the Ra-224 and Ra-226 series radionuclides in both the old and new 10 CFR Part 20 regulations for radiation protection. (See attached Tables A and B for comparison). It appears to be a conservatively protective choice. For decommissioning, we generally recommend the U.S. Environmental Protection Agency's (EPA's) Proposed National Primary Drinking Water Regulations, 40 CFR Parts 141 and 142, which were published on July 18, 1991, (56 FR 33050), as your cleanup criteria, in particular, 40 CFR 141.64, page 33126. These regulations are meant to be applied to drinking water supplies, and we consider them adequately protective for groundwater which is to be released for unrestricted use.

2. Page 2-4, Paragraph 2: It is recommended that gamma readings at grid intersections be supplemented with gamma surface scans. Our past experience has indicated that scanning 100 percent of "high-potential" areas and 20-50 percent of "mid-to-low-potential" areas selectively is extremely useful in the identification of areas requiring a more detailed assessment.

3. Page 2-4, Paragraph 3, 4 and 5: It is unclear where the area to be utilized for determination of background levels is located and how it will be selected. The data should be carefully evaluated if background levels are to be determined on the plant site.

4. Page 2-4, Paragraph 5: The soil concentration guidelines, as interpreted from the NRC Branch Technical Position, dated October 1981, (46 FR 52061), are stated as total thorium (Th-232 and Th-228) and total uranium (U-238 and U-234) pCi/g above background. If only gross alpha and gross beta analyses are scheduled ("certain soil....may also be subject to analysis for concentration of individual radioactive elements"), how will the comparison to guidelines be performed?

TABLE A

NRC Discharge Limits for Radium 226 Series Radionuclides in Unrestricted Areas Based on Old and New 10 CFR Part 20 Regulations

Radionuclide	Old 10 CFR Part 20 (January 1991). Table II, Column 2 - Maximum Permissible Concentrations (MPC's) in Water Above Natural Background in Unrestricted Areas		New 10 CFR Part 20 Table 2, Effluent Concentrations Column 2 Water	
	(μCi/ml) or (pCi/l)		(μCi/ml) or (pCi/ml)	
Radium-226	3E-8*	3E+1 (30)**	6E-8	6E+1 (60)
Lead -210	1E-7	1E+2 (100)	1E-8	1E+1 (10)
Bismuth -210	4E-5	4E+4 (40,000)	1E-5	1E+4 (10,000)
Polonium -210	7E-7	7E+2 (700)	4E-8	4E+1 (40)

* 3E-8 means $3x10^{-8}$ or ** 3E+1 means $3x10^{+1}$ or 30.

TABLE B

NRC Discharge Limits for Radium-224 Series Radionuclides in Unrestricted Areas Based on Old and New 10 CFR Part 20 Regulations

Radionuclide	Old 10 CFR Part 20 Appendix B, Table II, Column 2 Allowable Concentrations in Water		New 10 CFR Part 20 Appendix B, Table 2 Column 2 Effluent Concentrations for Water	
	(μCi/ml)	or (pCi/l)	(μCi/ml)	or (pCi/l)
Ra-224	2E-6	2E+3 (2,000)	2E-7	2E+2 (200)
Pb-212	2E-5	2E+4 (20,000)	2E-6	2E+3 (2,000)
Bi-212	4E-4	4E+5 (400,000)	7E-5	7E+4 (70,000)

5. Page 2-5, Paragraph 2: A minimum sampling frequency for surface and subsurface soils should be stated, e.g., sample(s) per m^2. In addition, analytical procedures must provide sufficient information upon which to compare site soil concentrations with guidelines. Gross alpha and gross beta analyses are generally not sufficient for this purpose.

6. Page 2-5, Paragraph 5, sentence 2: "Upwind samples will be analyzed for gross alpha and beta activity." See general comments regarding the use of gross alpha and gross beta activity determinations and guidelines.

   Page 2-5, Paragraph 5 sentence 3: "Results will be expressed both as pCi per standard cubic foot...," The concentrations of radioactivity in air should be expressed in units of "µCi/ml" to show compliance with NRC regulations, and for comparison to either the NRC's old 10 CFR Part 20, Appendix B, Table II, Column 1, Maximum Permissible Concentrations above background in air for individual radionuclides or the new (56 FR 23360) 10 CFR Part 20, Appendix B, to §§ 20.1001-2401, Table 2, Column 1, Effluent Concentrations in air.

7. Page 2-6, Paragraph 2: Define "statistically significant."

8. Page 2-6, Paragraph 3: See general comments.

9. Page 2-7, Paragraph 2: While the guidelines for building and equipment surfaces are given in terms of alpha radiation activity, in some facilities, it is appropriate to monitor beta radioactivity levels, as well as alpha radioactivity levels. Measurement of beta radioactivity may more accurately reflect the residual radioactivity present when surface conditions are such that alpha particles may be selectively attenuated. This occurs when the surfaces are wet, dirty, rusty, abraded, etc.

   Our experience has also indicated that gamma and alpha-beta scans can also be extremely effective in the identification of indoor areas requiring a more detailed assessment. See comment No. 2 for information on appropriate frequency of radiation scans. There is no mention of smears for the evaluation of removable contamination. If a gas flow proportional counter is used, will it be used in the alpha or alpha and beta mode?

10. Page 2-7, Paragraph 3: Which guideline will be used to compare the dust and dirt samples collected inside of the building?

11. Page 2-9, Paragraph 1: Is there any data or reference to support the statement, "No leaching of radioactive species is anticipated...." What type of analysis will be performed on the "washing effluent"? What about analysis for radionuclides other than thorium? Because some of the decay product radionuclides (e.g. Ra-226, Ra-228) have more stringent release limits in Table II of Appendix B, 10 CFR Part 20 than thorium, the washing effluent discharge process must be revised so that compliance with the discharge limits can be established.

12. Page 2-13, Section 2.1.2.6: Explain how you will insure that the excavation of materials (i.e., sludge) from Ponds No. 3 and 5 and closed Pond No. 2 will not leave behind residual radioactive (and for that matter, hazardous chemicals) contamination above NRC guidelines for cleanup of soil for unrestricted use.

13. Page 2-14, Section 2.1.2.8, Paragraph 2, Sentence 2: "If the soil is contaminated in excess of 10 picocuries per gram but less than 50 picocuries per gram, it may be blended with a sufficient volume of uncontaminated soil to result in a mixture that is less than 10 picocuries per gram and therefore suitable for release for unrestricted use." The NRC staff needs to know what specific radionuclide concentrations in soil above background are in excess of 10 picocuries per gram of soil and the volume of the contaminated soil or the spatial distribution of these radionuclides. We have to assume that the natural uranium and thorium at the site (e.g., in soil and sludge in Pond No. 3) contain radium-226 series (from U-238) and radium-224 series (from Th-232) of radionuclides at various stages of decay equilibria and geochemical and physical fractionation. The spatial distribution of the uranium, thorium, and the daughter radionuclides will have to be characterized in the soil and remaining sludge residues by isotopic analysis. Absent this information on the spatial distribution of the uranium and thorium series radionuclides in the soil, we will not approve this mixing or blending of the contaminated soil with clean soil. Our past experience with other licensed sites that have tried this dilution method has shown that it does not yield satisfactory results. We feel that your proposal to use the picocuries of gross alpha and gross beta activity that you measure to classify contaminated soil is flawed because these are not directly comparable to the acceptable concentrations in soil for specific radionuclides of natural uranium and thorium given in Options 1 and 2 of the 1981 NRC Branch Technical Position (46 FR 52061).

EPA's Office of Solid Waste and Emergency Response, Office of Emergency and Remedial Response and Office of Radiation Programs will be publishing in final form a Technical Bulletin entitled, "Characterization Protocol for Radioactively Contaminated Soil" in November 1991. This bulletin may provide guidance on how best to characterize and remediate contaminated soils. The person to talk to at EPA regarding this bulletin is either Mr. Robert Dyer or Dr. James Neiheisel at (202) 260-9630. For guidance on volume reduction methods for radioactively contaminated soil please contact Mr. Michael Eagle at (202) 260-9630. See also EPA guidance in "Assessment of Technologies for Remediation at Contaminated Superfund Sites," Report # EPA/540/2-90/001.

14. Page 2-15, Paragraph 2: See general comments.

15. Page 2-15, Paragraph 3: Does this mean a total of 20 samples from each remediated area or 20 for the entire site? See general comments regarding the use of gross alpha and gross beta data.

16. Page 2-15, Paragraph 4: Does this mean a total of 10 samples "from areas not previously found to contain contaminants"? What about areas for which there was a high potential for cross contamination as a result of remedial actions? See general comments regarding the use of gross alpha and gross beta data.

17. Pages 2-19 and 2-20: Decontamination techniques such as those described are of the type which significantly abrade building and equipment surfaces. Under these conditions, it is our experience that measurements for alpha activity should be supplemented and/or replaced with measurements for beta activity.

18. Page 2-21, Section 2.2.4, Paragraph 1: How will the radioactivity in the calciner exhaust be controlled?

19. Page 2-21, Paragraph 3: Is the analysis for wash waters to be limited only to gross alpha? If so, provide the rationale and explanation as to how the comparison of the gross alpha values will be made to the MPC's for individual radionuclides in 10 CFR Part Appendix B, Table II to show compliance with these effluent limits for individual radionuclides. See also comment No. 11 above.

20. Page 2-22, Paragraph 5: See general comments.

21. Page 2-22 and 2-23, Sections 2.2.5 and 2.2.6: Insufficient information is provided to evaluate the adequacy of the radioanalytical techniques to be used.

22. Page 2-23, Section 2.2.6, Paragraph 3: Our past experience with several other decommissioning projects at other sites indicates that dilution of contaminated soil is not an appropriate approach to radioactive waste management. This dilution method leads to unsatisfactory results and escalated cost for the licensees to clean up their sites. Also see our comment No. 12 above.

23. Page 2-25, Section 2.2.8.1, Paragraph 3: Beta-gamma detectors should also be calibrated to determine surface activity levels in units of dpm/100 cm^2.

24. Page 2-26, Paragraph 1: In the equation for activity, shouldn't the ratio of the detector area to 100 cm^2 be in the denominator? Is the instrument reading corrected for background?

25. Page 2-27, Paragraph 2: Why was the reference grid system changed from 10 m and 25 m blocks to 10 ft and 50 ft blocks?

26. Page 2-36, section 2.4.7.2, Last Paragraph, Last Sentence: "All reports and documents ... for easy access by authorized representatives of the Secretary of the Energy Department." This appears to need correction to refer to the Nuclear Regulatory Commission.